

RANGE EXTENSIONS, RANGE DEFINITIONS AND CALL STRUCTURES FOR FROGS FROM WESTERN AUSTRALIA

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ABSTRACT

Ranges are defined or extended for ten frog species from Western Australia: *Crinia subinsignifera*, *Litoria adelaidensis*, *Myobatrachus gouldii*, *Neobatrachus centralis*, *N. fulvus*, *N. kunapalari*, *N. pelobatoides*, *N. sutor*, *Notaden nichollsi* and *Pseudophryne guentheri*. Call structures are also defined for *Neobatrachus fulvus*.

INTRODUCTION

Tyler, Smith and Johnstone (1984) give the most recent data on the ranges and biology of frogs from Western Australia. However, since the publication of this book we have observed several species well outside the ranges reported by Tyler *et al.* (1984). Furthermore the ranges of some new species were poorly defined at the time of initial description (e.g. *Neobatrachus* species in Mahony and Roberts 1986). Here we report range extensions, define ranges or comment on range limits for *Crinia subinsignifera* Littlejohn, *Litoria adelaidensis* (Gray), *Myobatrachus gouldii* (Gray), *Neobatrachus pelobatoides* (Werner), *N. fulvus* Mahony and Roberts, *N. sutor* Main, *N. kunapalari* Mahony and Roberts, *N. centralis* (Parker), *Notaden nichollsi* Parker and *Pseudophryne guentheri* Boulenger.

Mahony and Roberts (1986) described *Neobatrachus kunapalari* and questioned the status of records of *N. centralis* from inland Western Australia. *N. kunapalari* and *N. centralis* both have tetraploid karyotypes but can be distinguished by the position of the nucleolar organiser region (Mahony and Robinson 1980; Mahony and Roberts 1986). Here we report the first certain occurrence of *N. centralis* in Western Australia and define the range of *N. kunapalari*.

Mahony and Roberts (1986) described *Neobatrachus fulvus* but had calls from only one specimen available. Because the data from a single specimen may be unrepresentative, here we report call data from an additional 24 specimens.

Specimen numbers (e.g. R 93203) refer to voucher specimens held in the Western Australian Museum. References to tape recordings are to cassettes or reel to reel tapes held in the collection of J. D. Roberts, Department of Zoology, University of Western Australia.

RESULTS AND DISCUSSION

Crinia subinsignifera

Main (1965) reported this species from near Manjimup to Cheyne's Beach just east of Albany. Tyler *et al.* (1984) reported only four records in the same general range. In late May 1990 we conducted field work between Albany and Cape Arid National Park, east of Esperance. The calls of *C. subinsignifera* were heard at many sites along the Hassell Highway north-east from Many

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Peaks as far east as the Pallinup River. A. Chapman (pers. comm. as a tape recording) has also recorded this species from the Fitzgerald River National Park. C. M. Majors and A. Savage heard and tape recorded this species on May 24, 1990 on Poison Creek Road in the Cape Arid National Park (Tape JDR#198, cuts 2 & 5; Tape JDR#199, cuts 1 - 3 & 5). *Crinia subinsignifera* may occur throughout the area from Cheyne's Beach to Cape Arid; the intervening area was not surveyed in detail. The Cape Arid record extends the range of this species east-north-east by almost 500 km.

Litoria adelaidensis

Tyler *et al.* (1984) figured the range of this species as extending north only to the Moore River. J.D. Richards recently collected two specimens of this species 15.7 km south-east of Port Gregory, north of Geraldton (WAM R113516-17). This record extends the range of this species north-north-west by more than 350 km.

Myobatrachus gouldii

This species has a wide distribution on the coastal plain north of Perth and in the central and south-eastern wheat-belt. The call of this species is distinct (Roberts 1981). On June 17, 1987, J.D. Roberts heard calls of this species at Mount Walker, 43 km north-north-east of Hyden, at Gibb Rock, 39.5 km north-north-east of Hyden, 6 km west of Gibb Rock and 73.5 km south of Southern Cross. G. Smith (CSIRO Division of Wildlife and Ecology, Helena Valley, W.A.) caught one specimen of this species in a pit trap on the Duracoppin Nature Reserve (north of Kellerberin) on December 4, 1990. These records extend the range of this species marginally to the east and north of that reported by Tyler *et al.* (1984) and the range defined by Roberts (1981). The record of calling by this species in June is also interesting. Roberts (1981) reported peak calling levels in a population near Perth in November but did not hear calling in mid-winter. None of the specimens at Mount Walker were seen: all were calling below a thick carpet of *Casuarina* needles. This is comparable with *Myobatrachus* from near Perth where calling early in the season is always from underground (Roberts 1981).

Neobatrachus centralis

We collected six specimens of this species from 21 km west-south-west of Mount Magnet (WAM R 103596-601) the calls of three of which were recorded (Cassette JDR#25, cuts 4 - 6, R 103596-8). We recorded another 7 specimens, 17 km south of Mount Magnet on January 6, 1989 and 28 February, 1989 (Cassette JDR#25, cuts 8 - 11 and Cassette JDR#28, cuts 2 - 4). These specimens have been identified by karyotype (M. Mahony, University of Newcastle, pers. comm.) and call. They are readily distinguished from *N. kunapalari* by body size (smaller in *N. centralis*) and the shape of the metatarsal tubercle (shape in *N. centralis* is comparable with that of *N. fulvus* - see Mahony and Roberts 1986 for illustration and comparison with metatarsal tubercle of *N. kunapalari*). However, although *N. centralis* is readily distinguished from *N. sutor* by karyotype (*N. sutor* is diploid, *N. centralis* is tetraploid), morphologically these two frogs are difficult to distinguish. Until morphological characters are defined to distinguish these two species, or, the ploidy level of preserved specimens is determined (Mahony and Robinson 1980 show this is possible with silver staining techniques), the distributions of *N. centralis* and *N. sutor* in W.A. will remain uncertain except where records are based on call or karyotype data (see below for *N. sutor*).

We have also heard calls like those of *N. centralis* near Cue, Menzies and Laverton. At

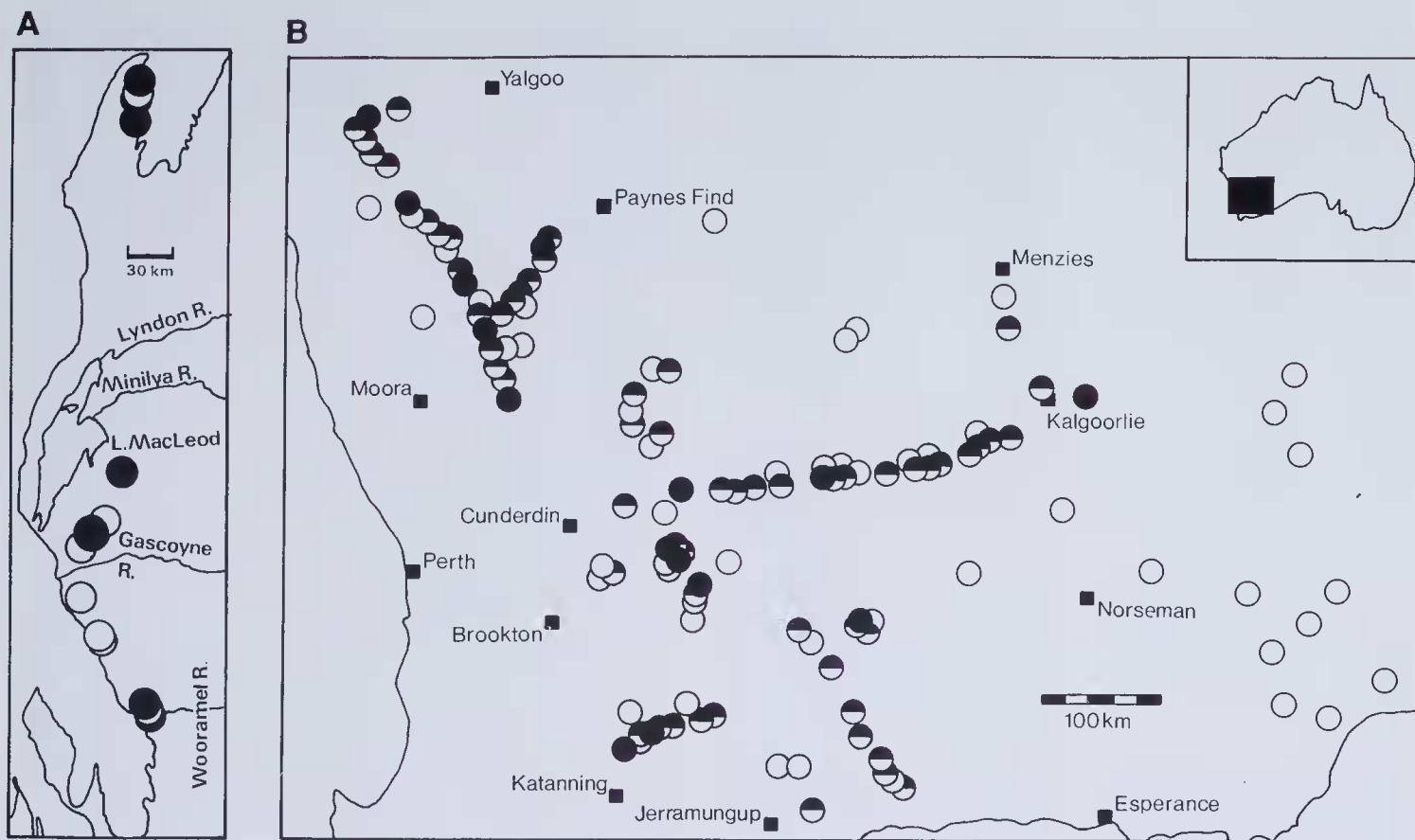


Figure 1 A, Distribution of *Neobatrachus fulvus*. Solid circles, sites where specimens have been recorded. Open circles sites where this species was heard calling. Where multiple data are available for a single site, call recordings take precedence over calls heard. B, Distribution of *Neobatrachus kunapalari*. Solid circles, sites with call recordings; half solid circles, sites where calls have been heard; open circles represent specimen records. Where multiple data are available for a single site, call recordings take precedence over calls heard, and calls heard are plotted in preference to specimen records.

Table 1 Call data for *Neobatrachus fulvus* - temperature independent variables. Values given are mean, standard error and range. The data for the single male reported by Mahony and Roberts (1986) are given in the bottom line.

n	Pulses per Call	Pulse Duration (ms)	Dominant Frequency (kHz)	Rise Time as % Duration	Temperature (°C)
Mean 23	16.81	15.0	1.530	49.04	25.1
S.E.	0.48	0.39	0.02	1.02	0.3
Range	12-21	9.7- 18.3	1.33-1.71	39.5-57.0	22.9-27.2
1986 1	13.7	16.6	1.503	50.0	23.2

Menzies calls like those of *N. kunapalari* were also heard. These two species may occur sympatrically. The nature of any interactions that may occur between them, such as whether they hybridize have not yet been defined. Records from sites where *N. kunapalari* and *N. centralis* may be sympatric are not plotted on Figure 1B.

Neobatrachus fulvus (Figure 1A)

This species was reported from Exmouth, Learmonth and Gnoraloo by Mahony and Roberts (1986). Following cyclonic rains in the Exmouth area in January, 1990 we recorded this species at several sites in the Exmouth - Learmonth area and at sites from the Wooramel River north to 80 km north-east of Carnavon. Sites where we heard or recorded calls of *N. fulvus* are given on Figure 1A. Specimen records reported by Mahony and Roberts (1986) are not included on Figure 1A.

This species was abundant at all sites visited. In the area between Exmouth and Learmonth *N. fulvus* was sympatric with *N. sutor*. *N. sutor* was not reported from the Exmouth region by Storr and Hanlon (1980). South of Minilya, *N. fulvus* was sympatric with both *N. sutor* and *N. wilsmorei*. The region between Learmonth and Minilya was not accessible due to flooding and was not surveyed. We have no data on the eastern or north-eastern extent of the range of *N. fulvus* but neither this species, nor any other *Neobatrachus* species, was observed between Devil Creek (49 km west-south-west of Karratha) and Toolunga Creek, approximately 66 km north of the Nanutarra Roadhouse (on the Ashburton River) after heavy rain associated with Cyclone Ian in early March 1992. *Cyclorana maini* and *Litoria rubella* were actively breeding following this rain: *C. maini* was heard at 32 sites and *L. rubella* at 6 sites.

Call analysis techniques for *N. fulvus* follow Mahony and Roberts (1986) except that pulse repetition rates were averaged over the whole call rather than over pulses 7 - 10. The call data reported here are from a total of 23 new frogs recorded at the following sites: 2.3 km south of Exmouth (n = 3); 0.5 km north of the Shothole Canyon turnoff (15 km S of Exmouth, n = 7); Learmonth Air Base (n = 4); Yalobia Outstation, approximately 80 km north-east of Carnavon (n = 4); Yoondoo Well (Yandoo Creek crossing on North-West Coastal Highway, approximately 32.5 km north-east of Carnavon, n = 3); 15 km north of the Wooramel River (n = 1) and 1 km south of the Wooramel Roadhouse (n = 1). All call variables were regressed on temperature. Only one call variable, pulse repetition rate, was significantly affected by temperature. For all variables we compared the mean values for the sample formed by the Learmonth - Exmouth area with those data from further south where there is an additional, sympatric *Neobatrachus* species. For temperature independent variables, comparisons were made by ANOVA run on Statview SE

+ Graphics on a Macintosh SE computer. In all cases there were no significant differences. Data from all sites were combined and are presented in Table 1. For pulse repetition rate, slopes and elevations of regression lines for the two zones were compared. There were no significant differences in either slope or elevation. For comparison with a slope of zero the overall regression was significant, $F_{1,22} = 22.57, p < 0.001$. The regression equation is: Pulses/second = $0.87 \text{ water temperature} - 3.52$. Standard error of the slope estimate is 0.18.

These extensive call data are directly comparable with the data from a single frog reported by Mahony and Roberts (1986). For pulses/second Mahony and Roberts reported a value of 14.2. The predicted value at 23.2°C is 16.66. Our earlier value is lower than expected but the proportion of variance explained by the regression is low ($r^2 = 0.51$) and equally divergent values occur within the data set.

Neobatrachus kunapalari (Figure 1B)

Mahony and Roberts (1986) broadly described the range of this species and speculated that many inland records of *N. centralis* in W.A. actually represented records of this species. Both the call and karyotype of *N. kunapalari* are distinct from those of *N. centralis* (Mahony and Roberts 1986; Mahony and Robinson 1980; Roberts, unpublished data for call). The morphology of these two species is also distinct (Parker 1940 *c.f.* Mahony and Roberts 1986). In Figure 1B we have plotted the distribution of *N. kunapalari*, based on data from sites where we have recorded *N. kunapalari* or heard it calling and on specimen records from the W.A. Museum collection (list of specimens examined in Appendix 1). This species is common in the eastern wheatbelt and adjacent goldfields and extends into the northeastern wheatbelt in a relatively narrow tongue. Contrary to suggestions by Mahony and Roberts (1986) this species does not occur in the inland desert regions of W.A.

Neobatrachus pelobatoides

The range of this species is reported as basically within the area of reliable winter rainfall (Main 1965) but with records extending east to Norseman and north-east to Morawa and Mount Jackson (Tyler *et al.* 1984). The call of this species can be distinguished from conspecifics by its low frequency, high pulse repetition rate and high pulse number (Mahony and Roberts 1986). C. M. Majors made tape-recordings from two specimens of this species on April 24, 1990, in a floodway 2.5 km north of Payne's Find on the Great Northern Highway (Cassette JDR #43, cut 1). Calls of this species were also heard in roadside ponds and floodways at sites on the Great Northern Highway 12.5 km south-west and 8.5 km north-north-east of Ninghan Station. Although these records extend the range of this species about 150 km east and north-east of previous records on the edge of the north-eastern wheatbelt the area has an annual rainfall and rainfall distribution comparable with sites near Norseman where *N. pelobatoides* has previously been recorded.

Neobatrachus sutor

Main (1965) and Tyler *et al.* (1984) report this species from sites in the goldfields, the north-eastern and central wheatbelt and two remote sites in the central desert (Jigalong and Warburton Range). The call of *N. sutor* is a distinctive, short click (Littlejohn and Main 1959). Using this character and based on field records of JDR from the last 14 years, we have plotted the distribution of *N. sutor*. We have heard this species at sites near Morawa, from Ninghan Station through to Meekatharra on the Great Northern Highway, from Exmouth to the Wooramel River

on the North-West Coastal Highway and from Menzies and Laverton. This is not a complete record of the distribution of this species as sites reported by Main (1965) and Tyler *et al.* (1984) are not included. We have never heard *N. sutor* on the western margin of the wheatbelt, immediately east of Perth as reported in Figure 1 of Main (1965). We have also never heard this species in the eastern wheatbelt after either summer or winter rains. Field work in the eastern wheatbelt after summer rains has covered the area from Northam to Merredin, Narembeen and Kondinin. Field work after autumn and early winter rains has covered similar areas but north to Bencubbin, east to Coolgardie, south to Hyden, Hopetoun and Jerramungup and north to Leonora and Laverton. This species is abundant at sites in the arid zone and may be widespread through western and into central Australia, with recent reports from Ayers Rock (Tyler and Davies 1986) and north-western South Australia (Tyler 1983). We have no evidence to suggest that *N. sutor* now occurs in the wheatbelt except in the north-east at the type locality, Gnoolowa Hill, and near Mingenew, Morawa and Mullewa. We suspect the records of *N. sutor* between Northam and Southern Cross and south-east of Southern Cross reported by Chapman and Dell (1985) may be mis-identified but this cannot be checked because Chapman and Dell (*op cit.*) did not give register numbers to support their data. In our experience immature *N. kunapalari* may easily be confused with *N. sutor*. Diploid and tetraploid species of *Neobatrachus* can be distinguished by red cell diameter (Mahony and Robinson 1980) and this character can be determined from dried blood smears. The preparation of such smears from future specimens could avoid mis-identification of *N. sutor*.

Notaden nichollsi

This species is widely distributed in northern and inland W.A. We collected 9 specimens (WAMR103572-80) near Yalobia Outstation, approximately 80 km north-east of Carnavon, on January 28, 1990. This represents a southwest range extension of approximately 500 km from the nearest coastal records at Dampier and Karratha and about the same distance from the southernmost inland records from near the Canning Stock Route. Frogs were collected from a large breeding chorus in a natural swamp. They were sympatric with *Neobatrachus fulvus*, *N. wilsmorei*, *N. sutor*, *Cyclorana platycephalus* and *C. maini*. We did not hear this species south of this locality (a further 8 sites were visited to just south of the Wooramel River on the same night), nor were they heard in the Exmouth-Learmonth area the previous night.

Pseudophryne guentheri

This species has been reported from sites throughout the wheatbelt and the forested areas of south-western Australia (Main 1965; Tyler *et al.* 1984). We collected a single specimen of this species 21 km south-east of Mount Magnet on the Yalgoo road on January 6, 1988 (WAMR101128). This species is distinguished from *P. occidentalis*, the only other congeneric species known from this area, by back pattern, ventral pattern (see detailed descriptions in Main 1965) and the number of phalanges in the inner toe (two in *P. occidentalis* and one in *P. guentheri*; Parker 1940). The single female specimen had characteristics of *P. guentheri* for all three distinguishing characters. This record apparently extends the range of this species approximately 250 km north-east of the nearest records of this species in the north-eastern wheatbelt reported by Tyler *et al.* (1984). However, Chapman and Dell (1985) reported a more extensive range for this species with one record close to the site noted above. We examined all available specimens of *Pseudophryne* held by the W.A. Museum from the area defined by latitudes 26 and 29° South and longitudes 115 and 119° East (Appendix 2). R84131-33 from 12 km south of Wuraga were *P. guentheri* judged by toe phalangeal formula. These are the closest

records to the site reported above for R101218. Three specimens could not be found: R56133 and R34282 -83. The former specimen is from 40 km south of Yalgoo. The latter were collected by W.H. Butler on November 7, 1965 from a site 20 miles west of Mount Magnet and are registered as *P. guentheri*. R101218 confirms Butler's record of *P. guentheri* from close to Mount Magnet and indicates that the distribution reported by Tyler *et al.* (1984) is incomplete.

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Appendix 1

Specimens of *Neobatrachus* from the W.A. Museum collection examined and identified as *N. kunapalari*. Data presented are: register number, latitude, longitude (latitude and longitude records (from W.A. Museum register data) as degrees and minutes south and east respectively in italics) and locality.

Specimens examined: 4336, 30°17', 116°45', Dalwallinu, east of; 9371-3, 9375-6, 9378-9, 9612, 10020, 29°13', 116°01', Morawa; 12902, 31°18', 119°43', Karalee, No 7 Pump, 13 km east; 17392, 32°22', 123°41', Noonoonia Home Stead, 5 miles south-west; 19634, 32°07', 123°11', Newman Rock; 19697, 32°55', 123°30', Coragina Rock; 9732, 31°30', 121°35', Widgiemooltha; 26386 and 26388, 29°56', 121°07', Comet Vale; 30646, 31°18', 119°08', Moorine Rock; 30647, 30°26', 123°34', Queen Victoria Spring; 30648, 31°02', 123°34', Zanthus; 30649, 31°18', 119°08', Moorine Rock; 30650-1, 29°10', 115°40', 18 Mile Creek, Morawa-Mingenew Road; 30652, 31°02', 123°34', Zanthus; 30653, 30°26', 123°34', Queen Victoria Spring; 30654, 31°01', 120°52', Bullabulling; 30655, 29°10', 115°40', 18 Mile Creek, Morawa-Mingenew Road; 30656, 31°18', 119°08', Moorine Rock; 30660, 31°01',

120°52', Bullabulling; 30662, 31°18', 119°08', Moorine Rock; 30663, 29°10', 115°40', 18 Mile Creek, Morawa-Mingenev Road; 30665, site cannot be located, Narrogin, Yarding turn-off; 30667, 31°18', 119°08', Moorine Rock; 30668, 31°02', 123°34', Zanthus; 30669, 31°18', 119°39', Yellowdine; 30670, 31°01', 120°52', Bullabulling; 30671, 29°13', 116°01', Morawa; 30672, 31°02', 123°34', Zanthus; 30673, site cannot be located, Narrogin, Yarding turn-off; 30674, 31°18', 119°39', Yellowdine; 30676, 30°26', 123°34', Queen Victoria Spring; 30677, 31°01', 120°52', Bullabulling; 32352, locality unknown, registered as *Hyla caerulea*; 32441, 31°18', 119°08', Moorine Rock; 32810-1, 32813-5, 32817, 32819-47, 32850, 29°13', 116°01', Morawa; 32851, 31°19', 119°04', Moorine Rock; 32852, 31°02', 123°34', Zanthus; 32853, site cannot be located, Narrogin, Yarding turn-off; 33040, 31°13', 119°28', Southern Cross, 7-10 miles east; 33041, 31°01', 120°52', Bullabulling; 33042, 29°10', 115°40', 18 Mile Creek, Morawa-Mingenev Road; 33045, 31°01', 120°52', Bullabulling; 36293-7, 31°17', 119°45', Southern Cross, 26 miles east; 36388-97, 36399-10, 36412-19, 30°55', 119°38', Lake Seabrook; 39171, 30°29', 118°07', Wialki; 39870, 33°29', 118°54', Greenfields Soak, 1 mile north-east; 39901, 33°30', 119°02', Greenfields Soak, 12 miles east; 40066-8, 32°59', 118°14', North Tarin Rock Reserve; 43664-5, 43667, 29°59', 116°36', Buntine Nature Reserve; 45333-4, 45336, 33°30', 119°08', Lake Magenta Reserve; 46385, 46387-8, 31°05', 118°01', Billyacating Nature Reserve; 48668-74, 48696, 30°28', 123°34', Queen Victoria Spring, 3 km south; 49573, 49792, 33°02', 117°43', Dongolocking Nature Reserve; 50150-1, 50158-9, 30°14', 116°56', Dalwallinu, 20 km east; 51126-7, 30°13', 116°49', Dalwallinu, 12 km north-east; 52413-5, 52417-9, 31°52', 117°33', Quairading, 21 km north-east; 52419, 20°50', 116°58', Jibberding; 52479-81, 31°59', 117°30', Quairading, 11 km east, Badjaling Nature Reserve; 52499, 52548, 32°01', 117°31', Quairading, 13 km east; 52623, 32°22', 118°21', Bending, 8 km north-east; 57581, 57773, 30°03', 116°05', Marchagee, 15 km north; 59535, 59549, 31°53', 118°40', Bruce Rock, 57 km east; 59932-3, 32°28', 123°25', Charlina Rock, 12 km north; 65064, 31°57', 122°18', Pioneer Siding, 62 km bearing 97 degrees; 65143, 32°23', 119°45', Lake Cronin, 0.6 km west; 65202, 32°23', 119°45', Lake Cronin, 0.7 km west-south-west; 65208, 32°23', 119°45', Lake Cronin, 0.6 km west; 65327, 32°03', 120°42', McDermid Rock, 6.3 km south-west; 65659, 30°41', 123°22', Cundeelee Mission, 8 km north-west; 66170, 32°02', 120°42', McDermid Rock, 3.7 km south-south-west; 68258, 30°00', 116°36', Buntine Reserve; 70789, 30°32', 122°16', Yowie Rockhole, 10 km bearing 220 degrees; 72136-7, 30°18', 119°42', Bungalbin Hill, 12 km north-north-east; 72152-6, 30°12', 119°49', Bungalbin, 25 km north-east; 72215, 72229-30, 72275, 72281, 72294, 31°13', 120°19', Boorabbin, near; 74322-5, 74327-38, 74340-3, 32°00', 120°45', McDermid Rock, 3 km east; 74409, 31°13', 120°19', Boorabbin, near; 81638-40, 20°50', 116°58', Jibberding; 87392, 29°17', 118°37', Lake Barlee and Vermin Fence, between; 91626, 32°55', 124°27', Toolinna Rockhole, 53 km west-north-west; 93175, 32°04', 123°57', Kilidwerinia Granite Rock, 5 km east-south-east; 93203, 32°04', 124°01', Balladonia Hotel-Motel, 50 km north-east; 93206, 33°00', 123°56', Balladonia, Six Mile; 93486-8, 31°36', 118°12', Hines Hill, 14 km south-east; 93489-90, 31°33', 118°12', Merredin, 8 km south-west; 93491, 31°36', 118°12', Hines Hill, 14 km south-east; 93492, 31°53', 118°51', Bruce Rock; 93493, 32°10', 118°20', South Kuminin, 2 km north; 93561-2, 31°33', 118°12', Merredin, 8 km south-west; 94665, 33°35', 120°03', Ravensthorpe; 97259-61, 31°18', 119°43', Karalee, No 7 Pump, 13 km east; 101187, 33°32', 120°00', Ravensthorpe, 7 km north-north-west; 101188, 32°30', 119°24', Holt Rock, 20 km north; 101189, 29°47', 116°27', Latham, 3 km south-south-east; 101190-1, 30°27', 116°08', Perenjori, 20 km north-north-west; 101192-8, 29°11', 116°01', Morawa, 4 km north; 101199, 30°27', 116°08', Perenjori, 20 km north-north-west; 101200, 28°31', 115°42', Pindar, 10 km west-south-west; 101201, 33°25', 119°56', Ravensthorpe, 20 km north-north-west; 101202-8, 31°58', 117°51', Yoting; 101209, 30°59', 117°51', Bencubbin; 101210-1, 30°50', 117°51', Bencubbin, 2 km south; 101212, 32°10', 118°20', Narembene, 13 km south-south-west; 101213, 29°35', 117°09', Ninghan Station, 21 km south-south-west; 101214-6, 30°24', 119°38', Bungalbin; 101207, 31°58', 117°51', Yoting; 106124, 21°34', 117°10', Ninghan Station, 21 km south-south-west.

Appendix 2

Pseudophryne specimens from near Mount Magnet: WAM Register Numbers. Specimens identified by phalangeal formula for inner toe.

Specimens: 34282 - 83, not located; 35294, *P. occidentalis*; 51663, *P. occidentalis*; 54210 - 13, *P. occidentalis*; 56133, not located; 84131 - 33, *P. guentheri*; 87778, *P. occidentalis*; 101218, *P. guentheri*.